Hole's Human Anatomy and Physiology

Twelfth Edition

Shier ◆ Butler ◆ Lewis

Chapter 1

Introduction to Human Anatomy &

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1.1: Introduction

- Questions and observations that have led to knowledge.

- Knowledge about structure and function of the human body.

1.2: Anatomy & Physiology

- Anatomy – the study of the structure of the human body

- Physiology – the study of the function of the human body

"The complementarity of structure and function."

1.3: Levels of Organization

- Subatomic Particles – electrons, protons, and neutrons
- Atom – hydrogen atom, lithium atom, etc.
- Molecule – water molecule, glucose molecule, etc.
- Macromolecule – protein molecule, DNA molecule, etc.
- Organelle – mitochondrion, Golgi apparatus, nucleus, etc.
- Cell – muscle cell, nerve cell, etc.
- Tissue – epithelia, connective, muscle and nerve
- Organ – skin, femur, heart, kidney, etc.
- Organ System – skeletal system, digestive system, etc.
- Organism – the human

Levels of Organization

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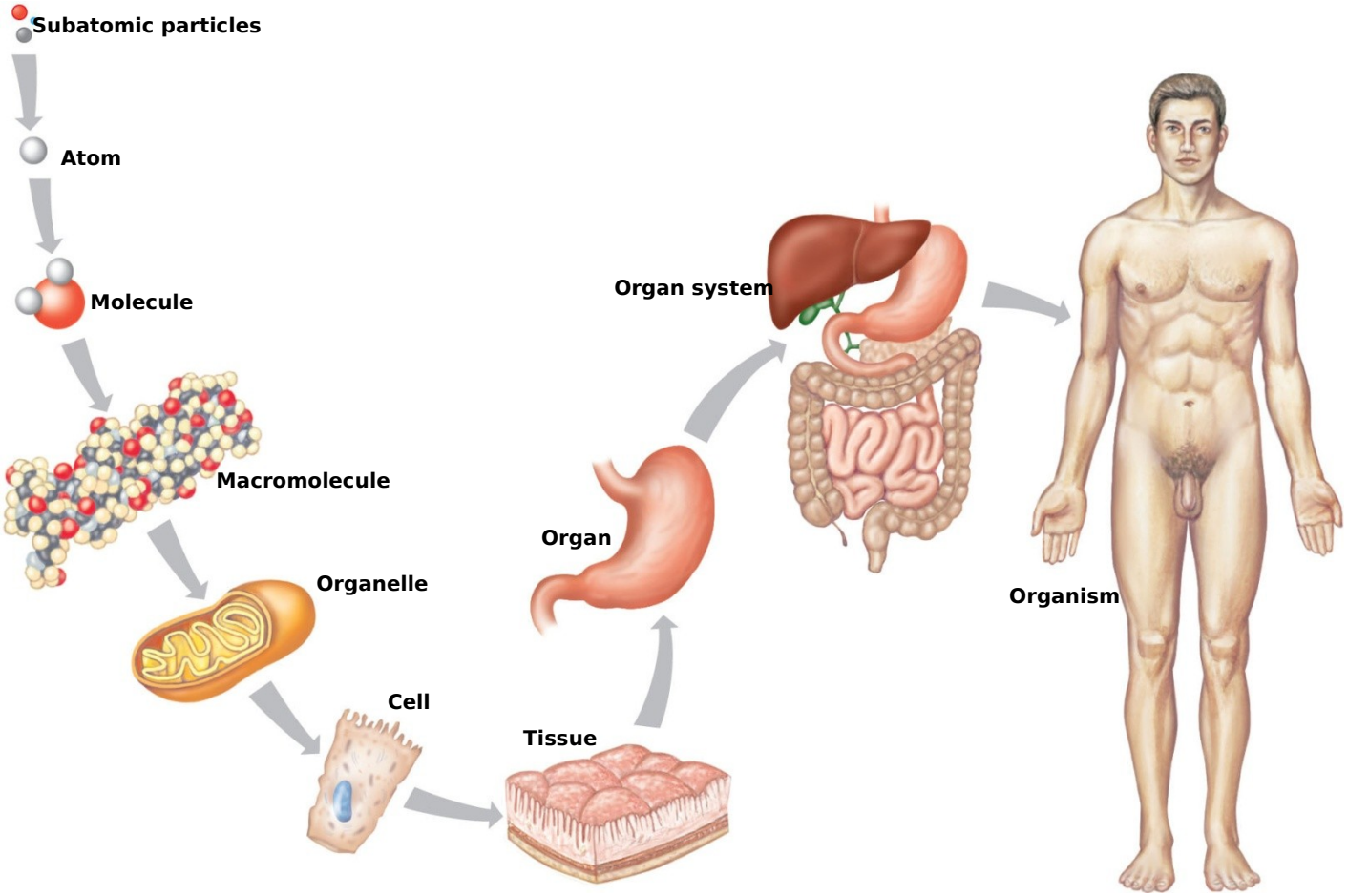

Organ Systems

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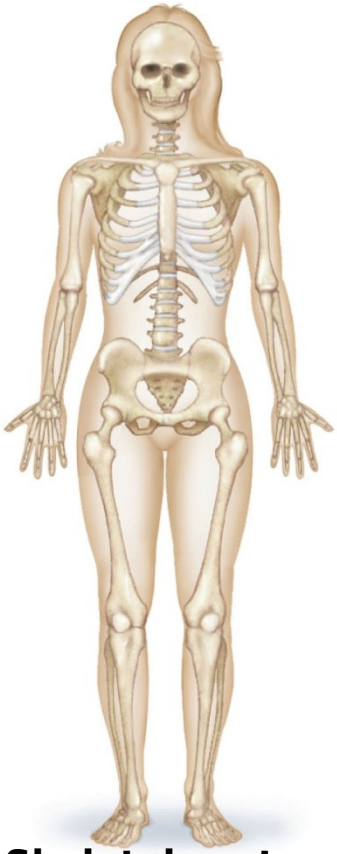
Integumentary system



Skeletal system

Muscular system

Organ Systems

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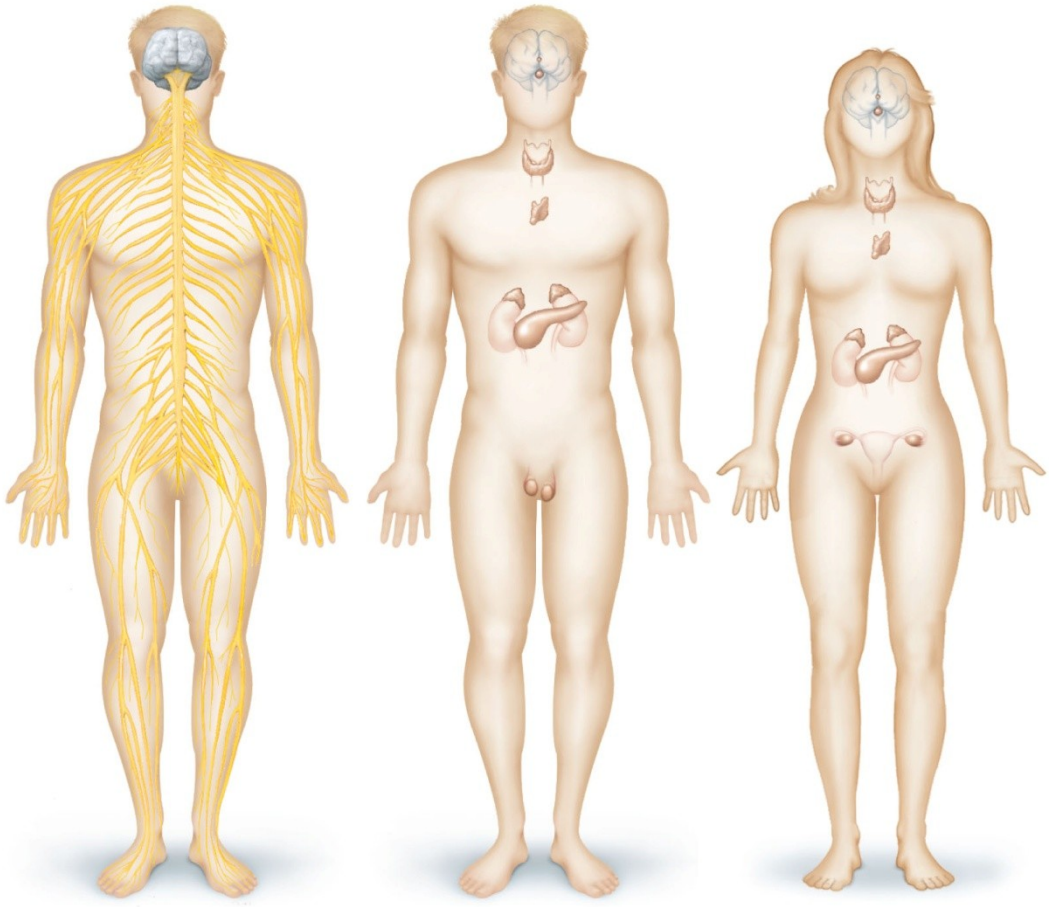

Nervous system

Endocrine system

Organ Systems

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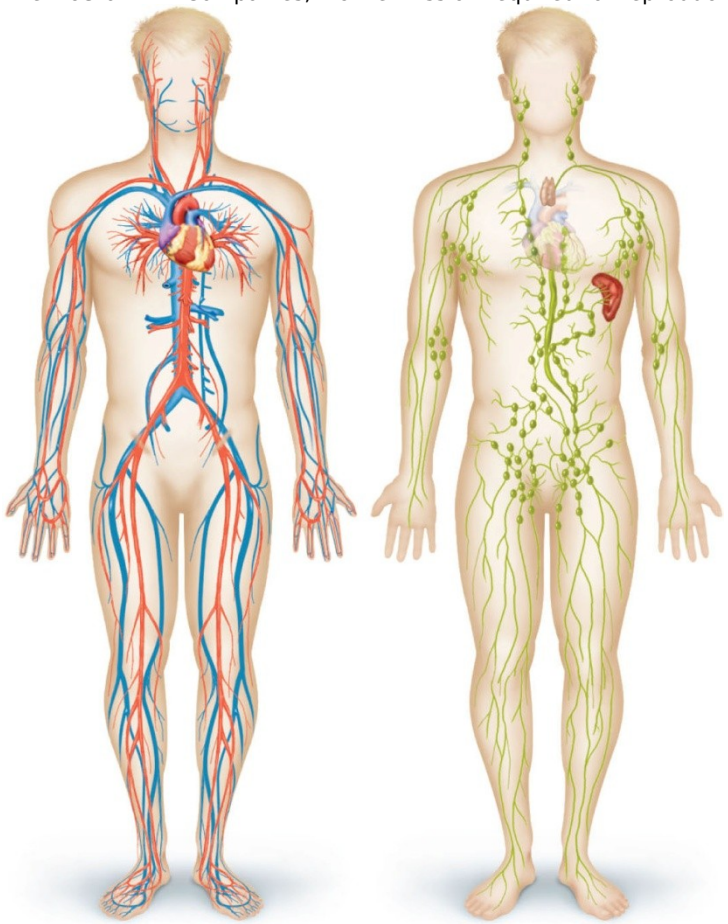

Cardiovascular system **Lymphatic system**

Organ Systems

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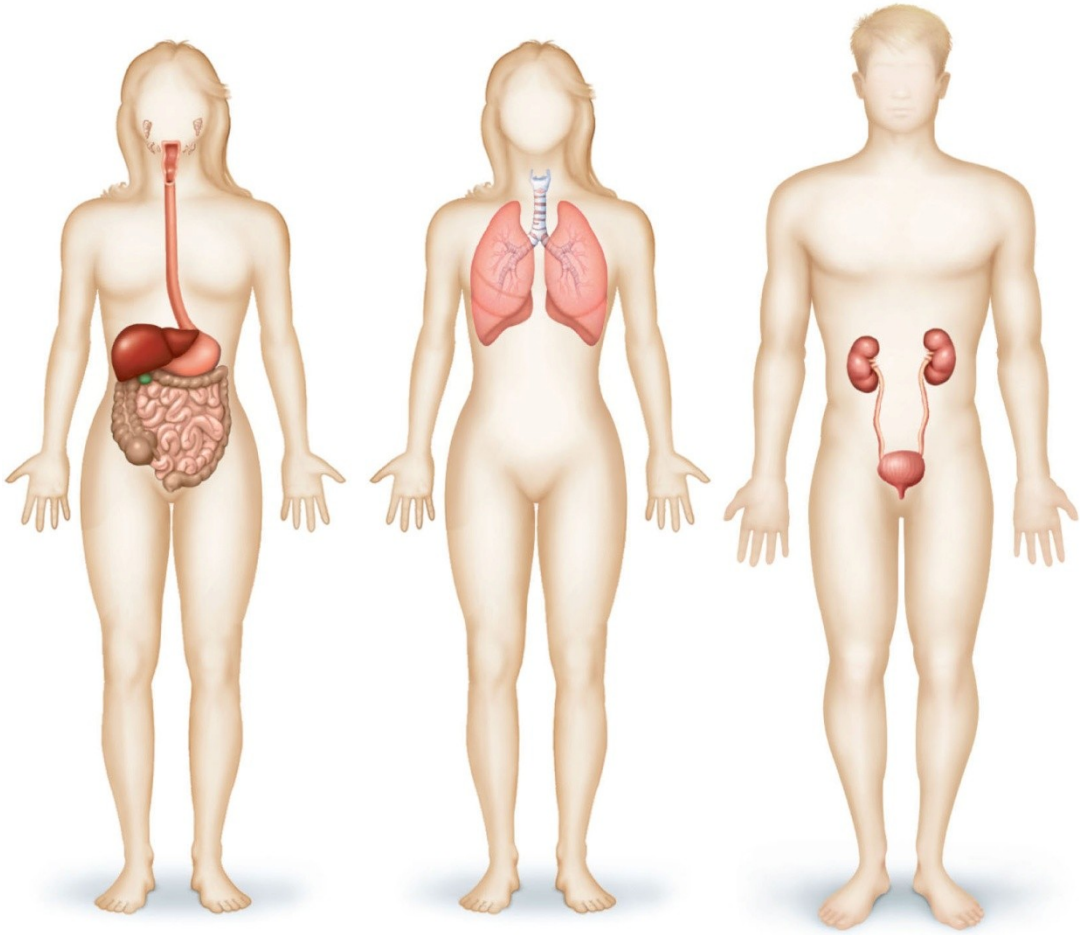

Digestive system **Respiratory system** **Urinary system**

Organ Systems

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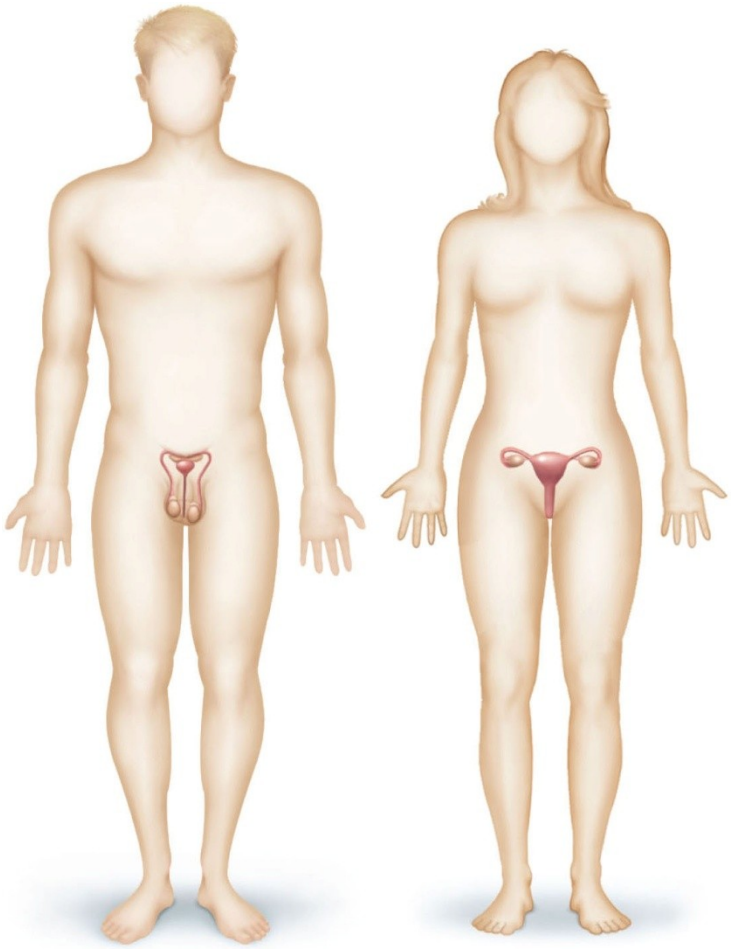

Male reproductive system **Female reproductive system**

1.1 Clinical Application

- **Ultrasound (US)**
- **Magnetic Resonance Imaging (MRI)**

1.4: Characteristics of Life (10)

- Movement – change in position; motion
- Responsiveness – reaction to a change
  - Growth – increase in body size; no change in shape
  - Reproduction – production of new organisms and new cells
  - Respiration – obtaining oxygen; removing carbon dioxide; releasing energy from foods

Characteristics of Life Continued

- Digestion – breakdown of food substances into simpler forms

- Absorption – passage of substances through membranes and into body fluids

- Circulation – movement of substances in body fluids
- Assimilation – changing of absorbed substances into chemically different forms

- Excretion – removal of wastes produced by metabolic reactions

1.5: Maintenance of Life

- Life depends on five (5) environmental factors:
  - Water
  - Food
  - Oxygen
  - Heat
  - Pressure

Requirements of Organisms

- Water
  - most abundant substance in body
  - required for metabolic processes
  - required for transport of substances
  - regulates body temperature

- Food
  - provides necessary nutrients
  - supplies energy
  - supplies raw materials

Requirements of Organisms

- Oxygen (gas)
  - one-fifth of air
  - used to release energy from nutrients

- Heat
  - form of energy
  - partly controls rate of metabolic reactions

- Pressure
  - application of force on an object
  - atmospheric pressure – important for breathing
  - hydrostatic pressure – keeps blood flowing

Homeostasis*

* ***Maintaining*** of a stable internal environment

- Homeostatic Control Mechanisms – monitors aspects of the internal environment and corrects as needed. Variations are within limits. There are three (3) parts:
  - Receptor - provides information about the stimuli
  - Control Center - tells what a particular value should be (called the set point)
  - Effector - elicits responses that change conditions in the internal environment

Homeostatic Control Mechanisms

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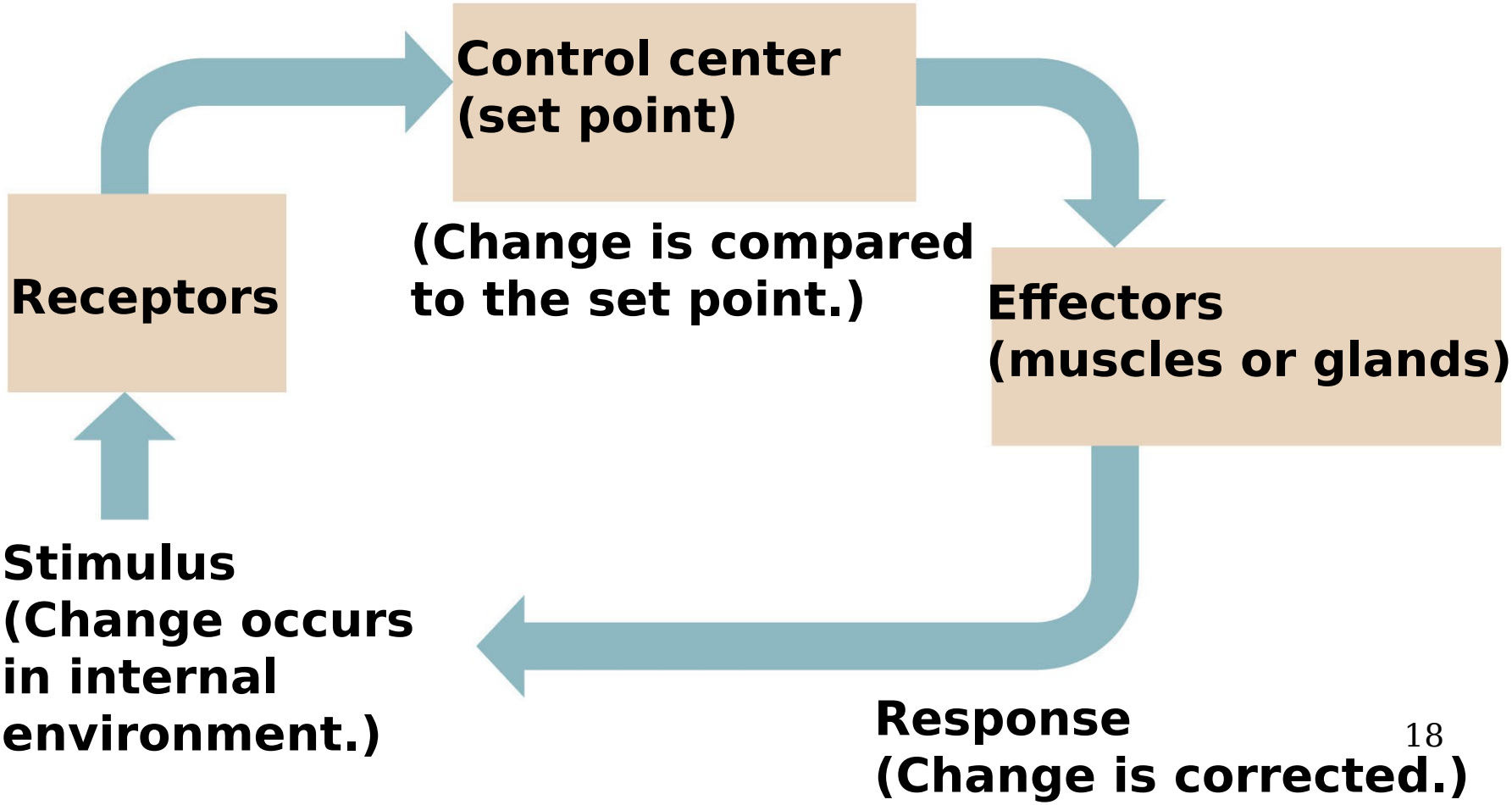

Homeostatic Control Mechanisms

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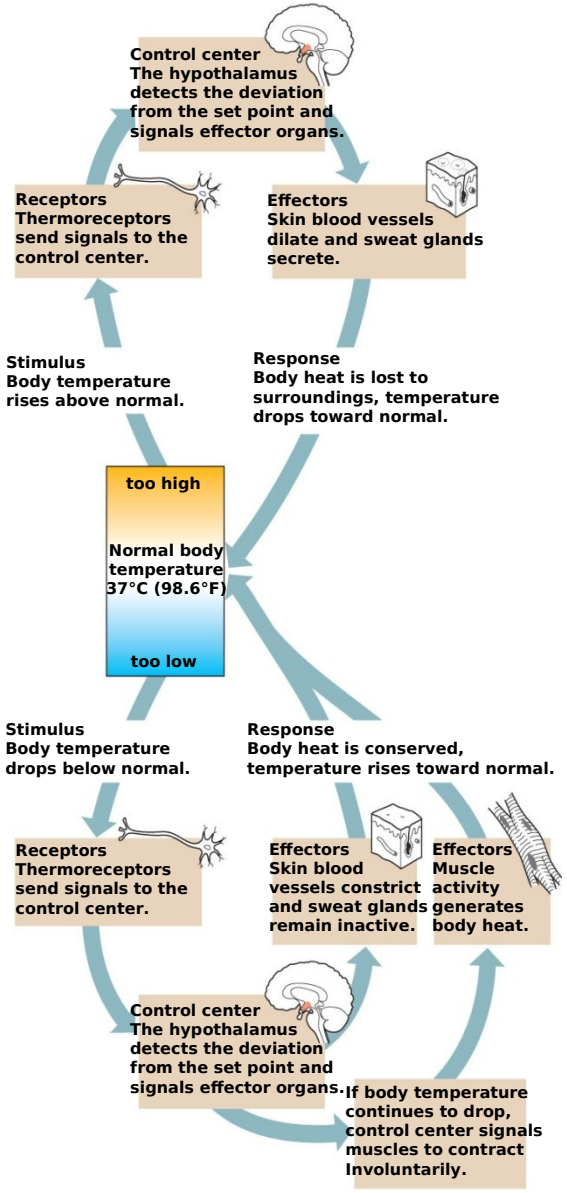

Control center
The hypothalamus detects the deviation from the set point and signals effector organs.
Receptors
Thermoreceptors send signals to the control center.
Effectors
Skin blood vessels dilate and sweat glands secrete.
Stimulus
Body temperature rises above normal.
Response
Body heat is lost to surroundings, temperature drops toward normal.
too high
Normal body temperature 37°C (98.6°F)
too low
Stimulus
Body temperature drops below normal.
Response
Body heat is conserved, temperature rises toward normal.
Receptors
Thermoreceptors send signals to the control center.
Effectors
Skin blood vessels constrict and sweat glands remain inactive.
Effectors
Muscle activity generates body heat.
Control center
The hypothalamus detects the deviation from the set point and signals effector organs.
If body temperature continues to drop, control center signals muscles to contract involuntarily.

Homeostatic Control Mechanisms

- There are two (2) types:
  - Negative feedback mechanisms
  - Positive feedback mechanisms

Homeostatic Control Mechanisms

Negative feedback summary:

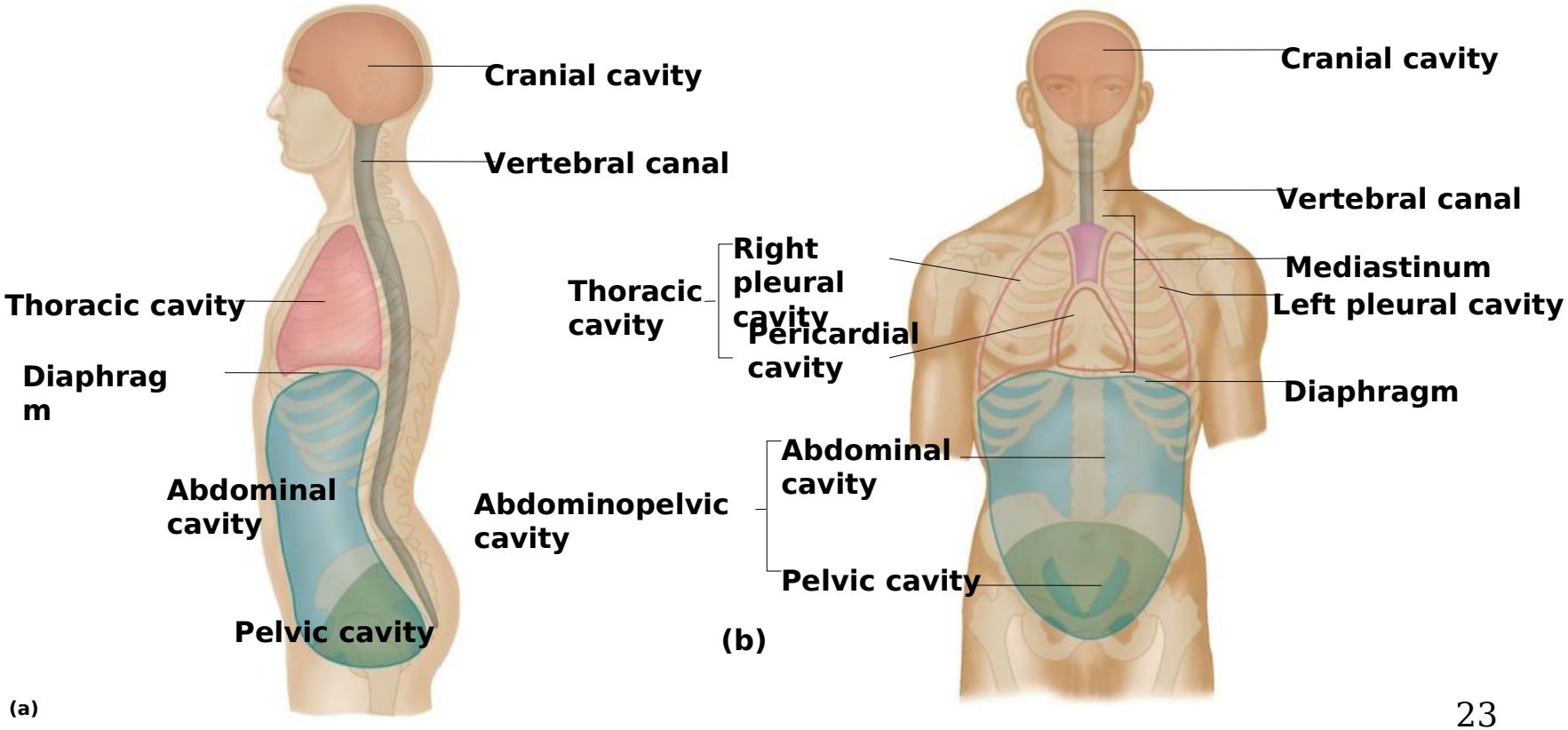
- Prevents sudden, severe changes in the body
- Corrects the set point
- Causes opposite of bodily disruption to occur, i.e. the ‘negative’
- Most common type of feedback loop
- Examples: body temperature, blood pressure & glucose regulation

Homeostatic Control Mechanisms

Positive feedback summary:

- Increases (accelerates) the actions of the body
- short-lived
- do not require continuous adjustments
- Examples: blood clotting and child birth

1.6: Organization of the Human Body



Thoracic & Abdominal Serous Membranes

- Visceral layer – covers an organ
- Parietal layer – lines a cavity or body wall

Thoracic Membranes

- Visceral pleura
- Parietal pleura
- Visceral pericardium
- Parietal pericardium

Abdominopelvic Membranes

- Parietal peritoneum
- Visceral peritoneum
- Parietal perineum
- Visceral perineum

Serous Membranes

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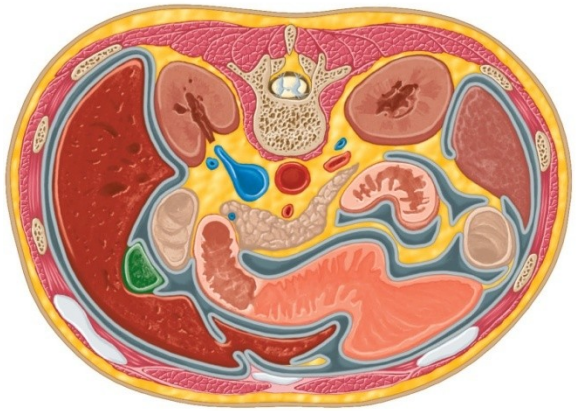

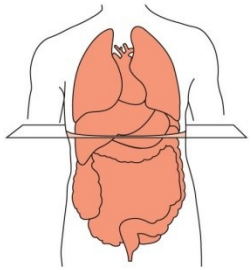

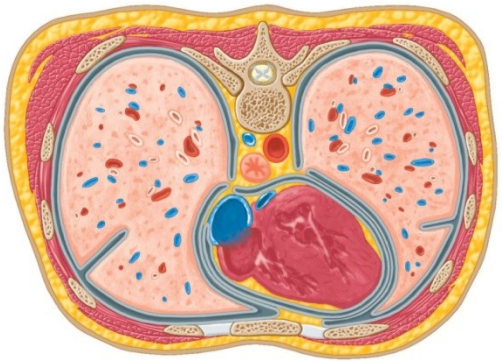

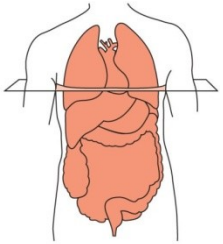

1.7: Lifespan Changes

Aging occurs from the microscopic level to the whole-body level.

Can you think of some examples?

1.8: Anatomical Terminology

Anatomical Position – standing erect, facing forward, upper limbs at the sides, palms facing forward and thumbs out

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Integumentary system

Anatomical Terminology: Orientation and Directional Terms

- Terms of Relative Position (based on anatomical position):
  - Superior versus Inferior (Cranial vs. Caudal)
  - Anterior versus Posterior (Ventral vs. Dorsal)
  - Medial versus Lateral
  - Ipsi-lateral versus Contra-lateral
  - Proximal versus Distal
  - Superficial versus Deep
  - Internal versus External

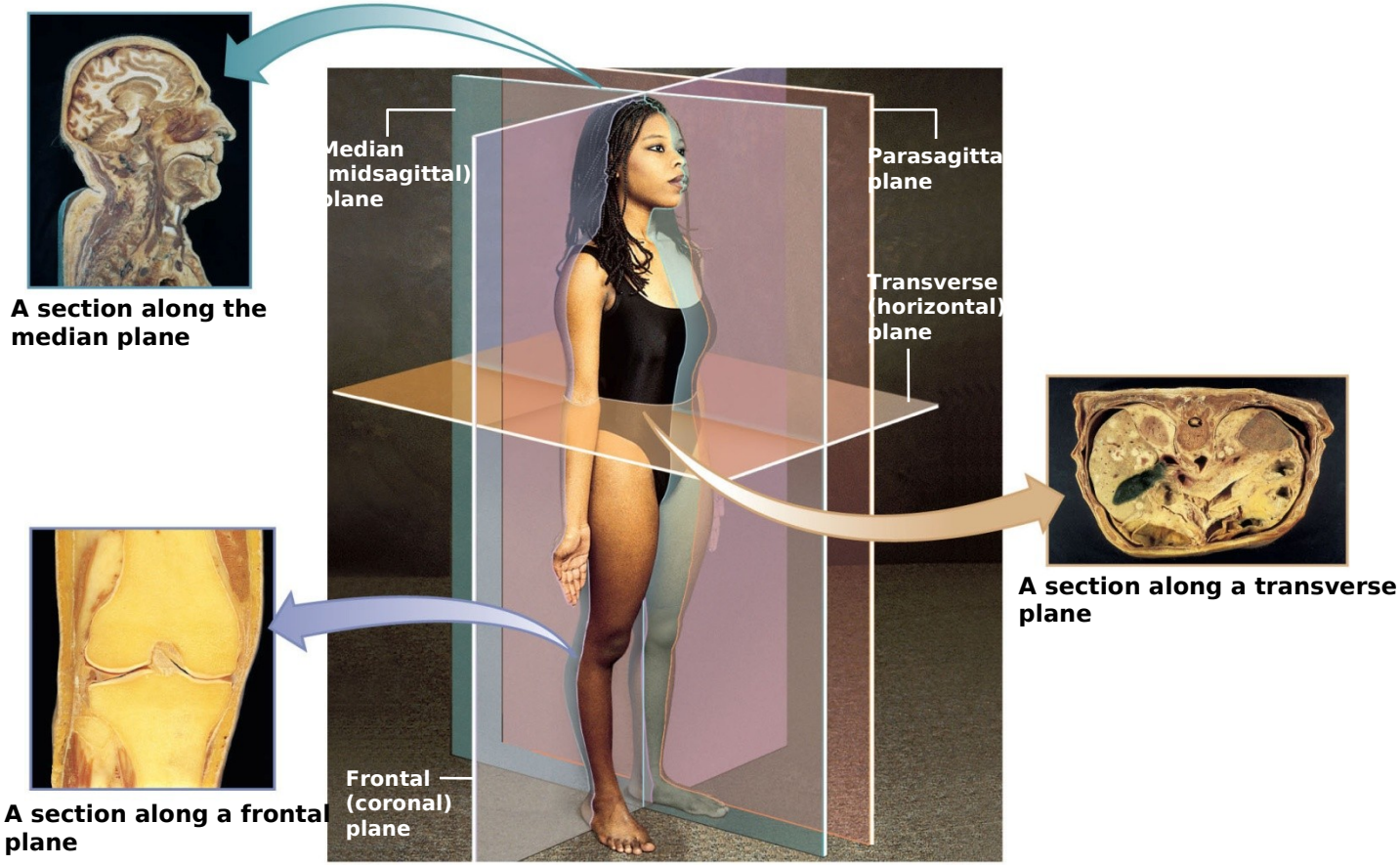
Body Sections or Planes

- **Sagittal or Median** – divides body into left and right portions
  - Mid-sagittal – divides body into equal left and right portions

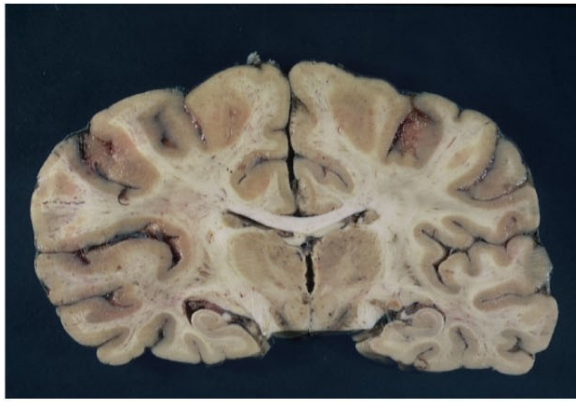
- **Transverse or Horizontal** – divides body into superior and inferior portions

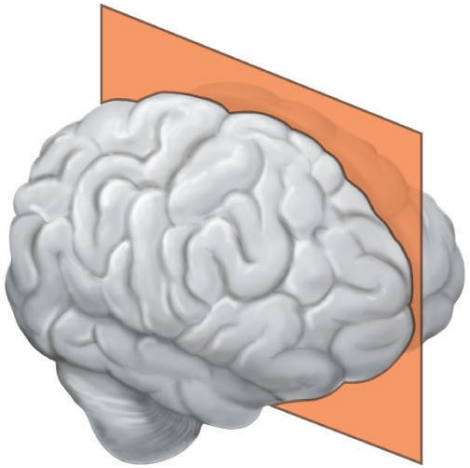
- **Coronal or Frontal** – divides body into anterior and posterior portions

Body Sections


A section along the median plane
Median (midsagittal) plane
Parasagittal plane
Transverse (horizontal) plane
A section along a transverse plane
A section along a frontal plane
Frontal (coronal) plane

Body Sections





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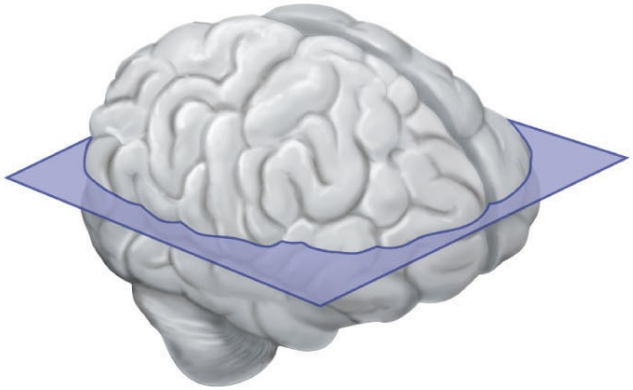

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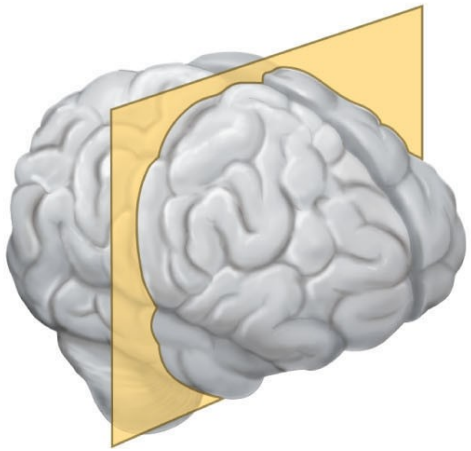
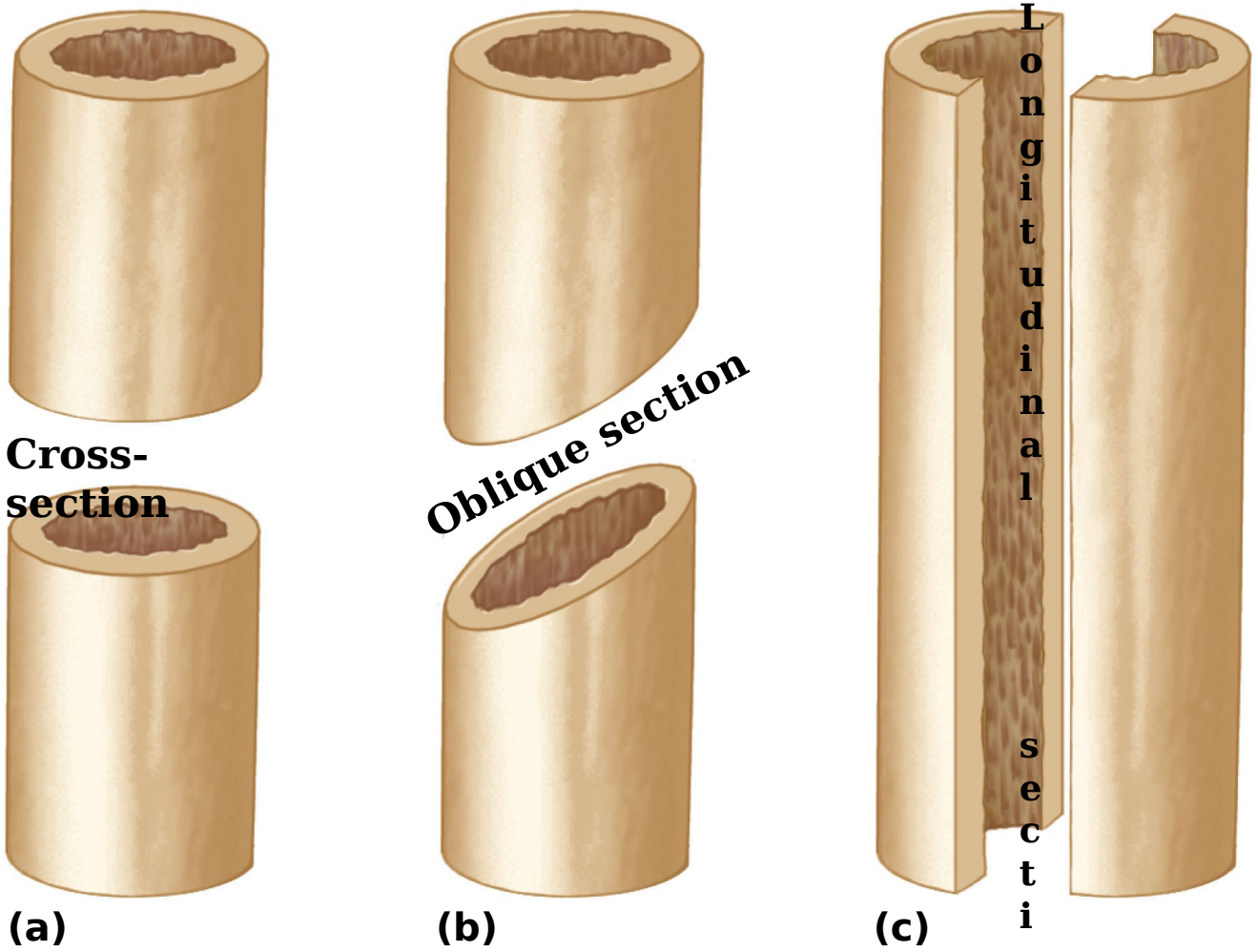
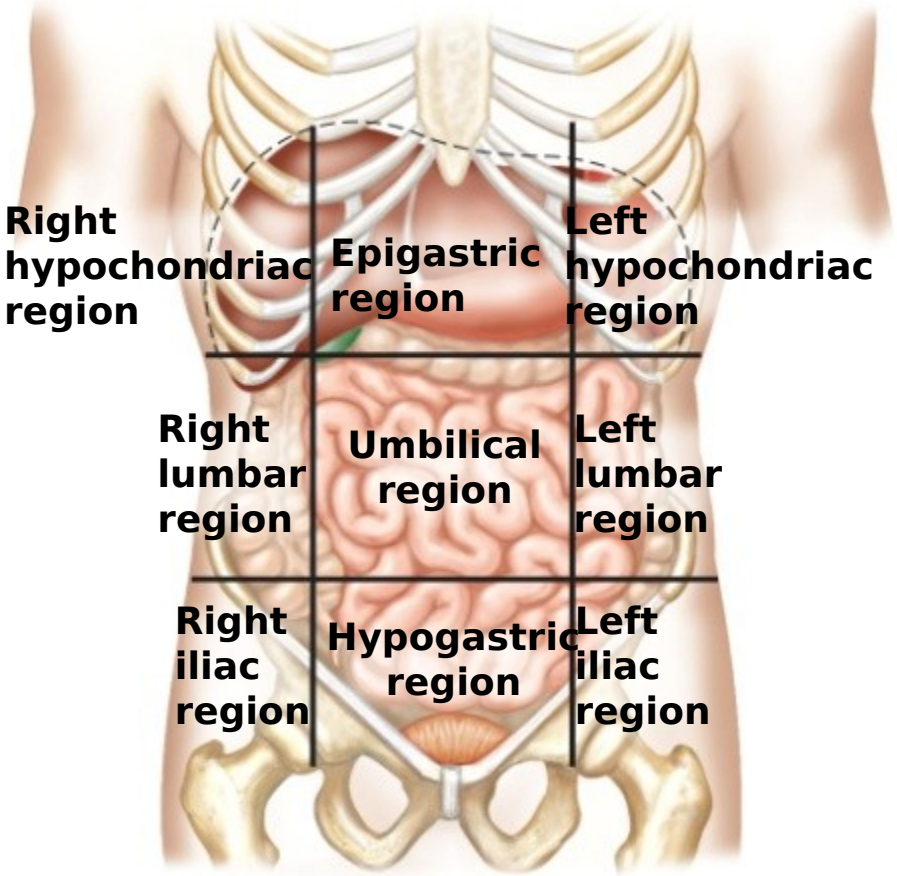


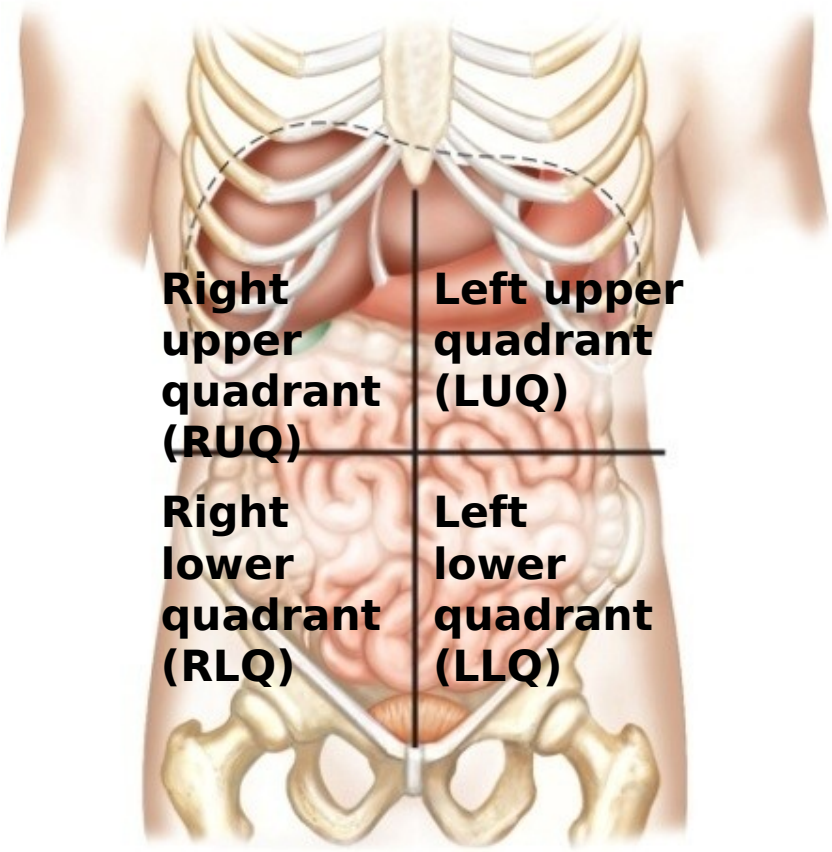
(c)

Other Body Sections



Abdominal Subdivisions





Body Regions

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